# NetCentric Warfare:
# *Technology Driven Agility*

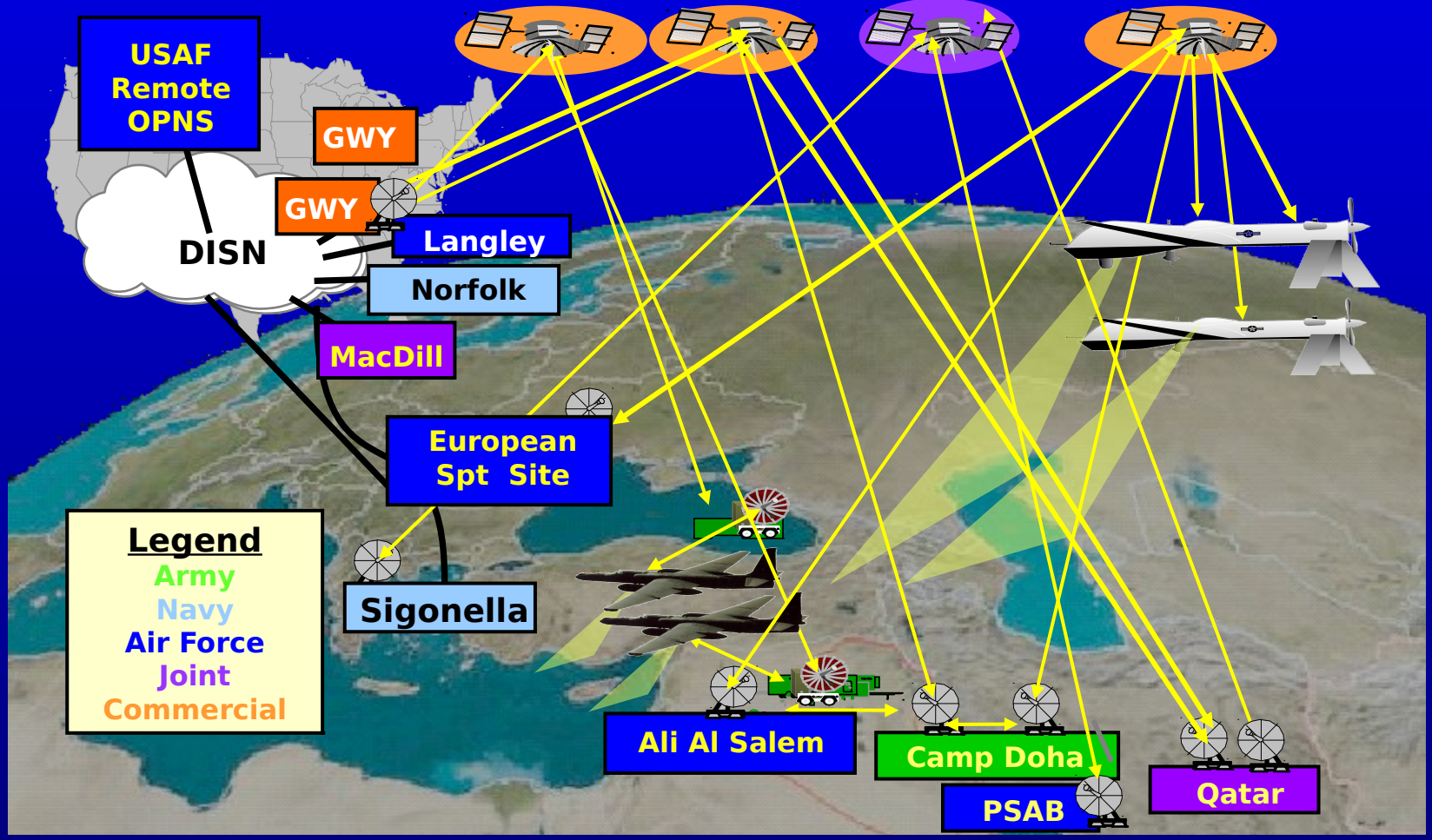
**Dawn Meyerriecks**
**rincipal Director, Global Information Grid Enterprise Services**
**(703)882-1000**
**meyerrid@ncr.disa.mil**

**“Freedom is not synonymous with an easy life…. There are many difficult things about freedom: It does not give you safety, it creates moral dilemmas for you; it requires self-discipline; it imposes great responsibilities; but such is the nature of Man and in such consists his glory and salvation.”**

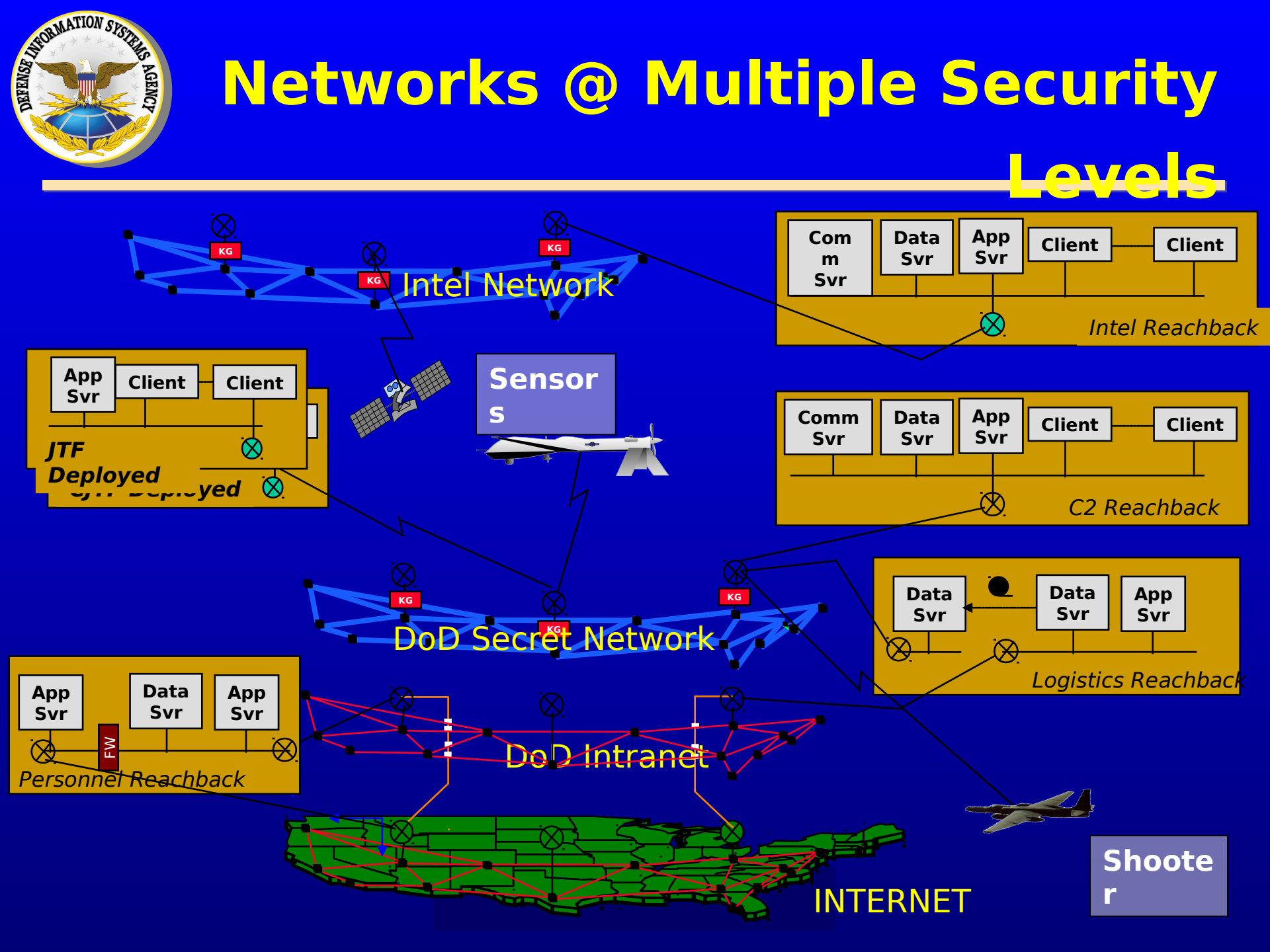
***Margaret Thatcher***

# Current Operations Support : A Sample Operational Thread

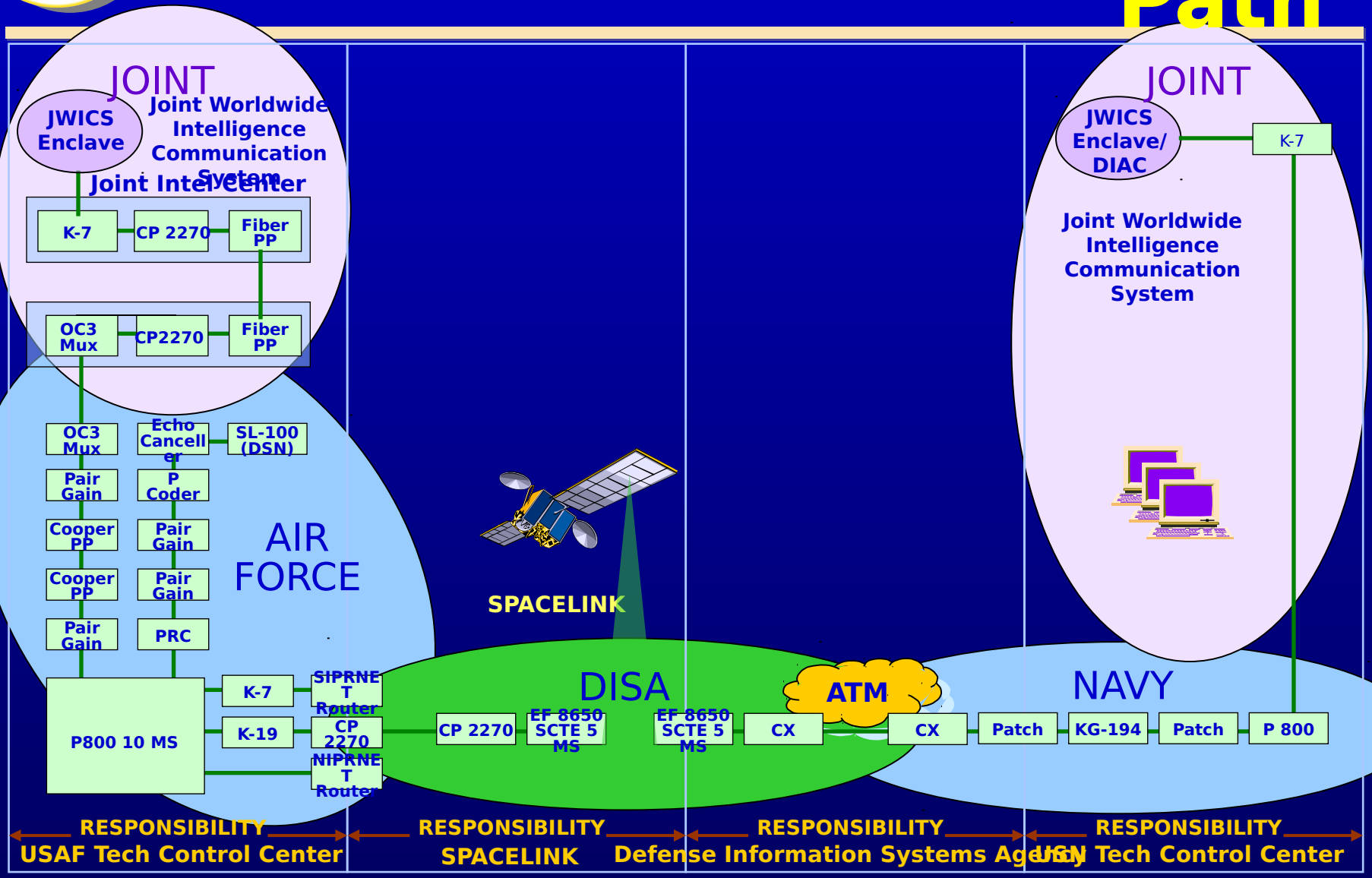
# Sample Mission Thread: Battle Damage Assessment to Target



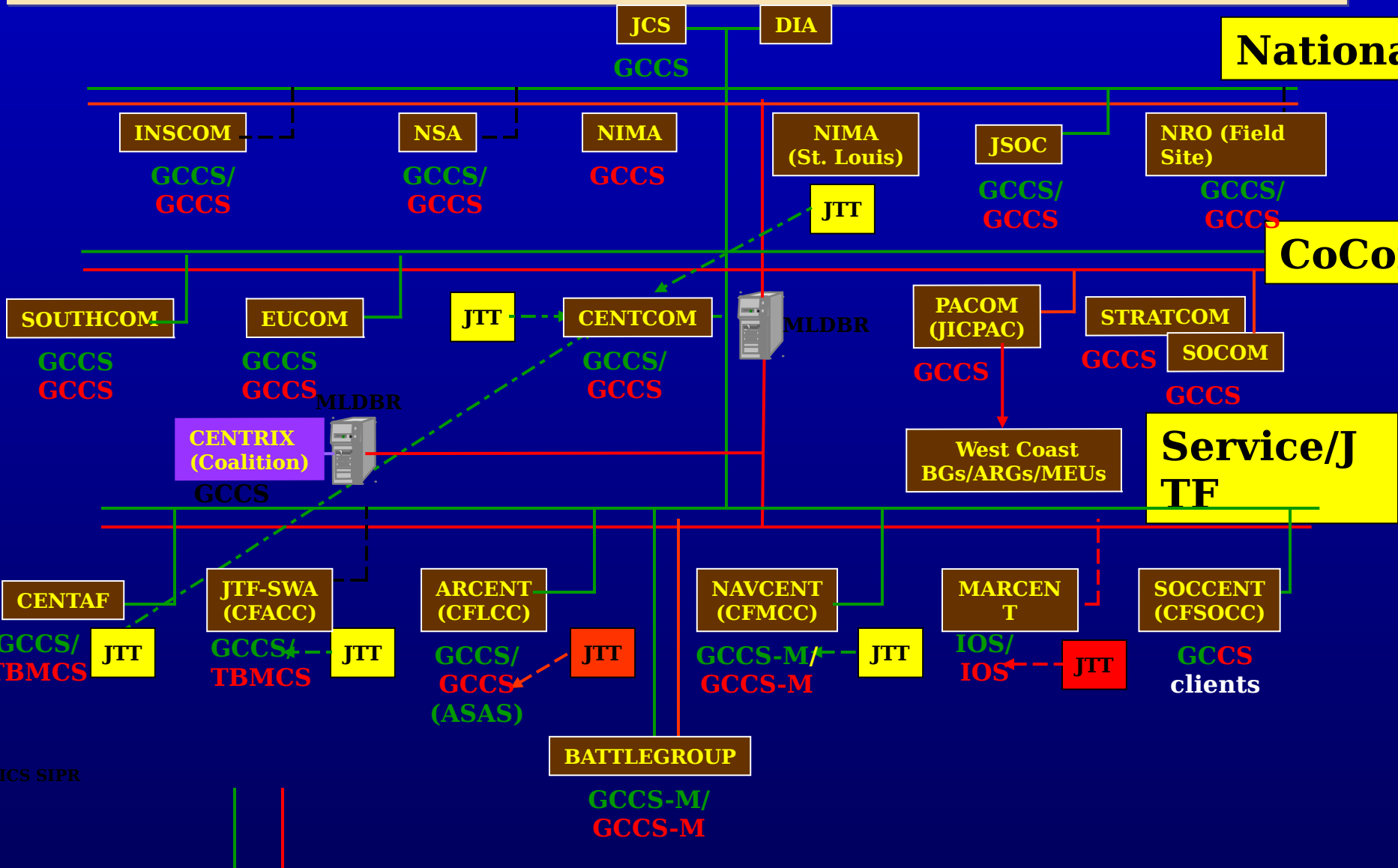
# Networks @ Multiple Security Levels



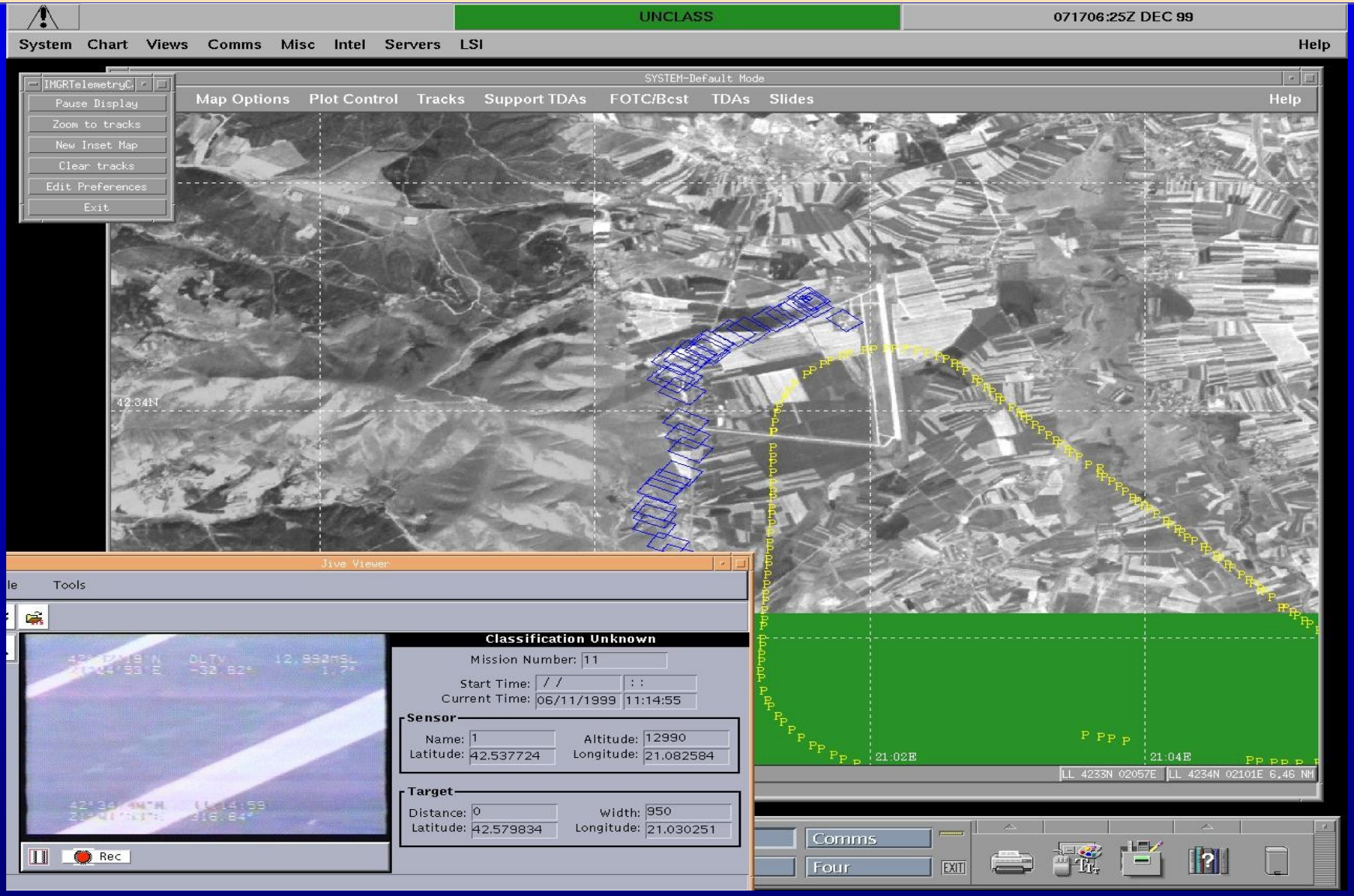
# Communications Relay Path



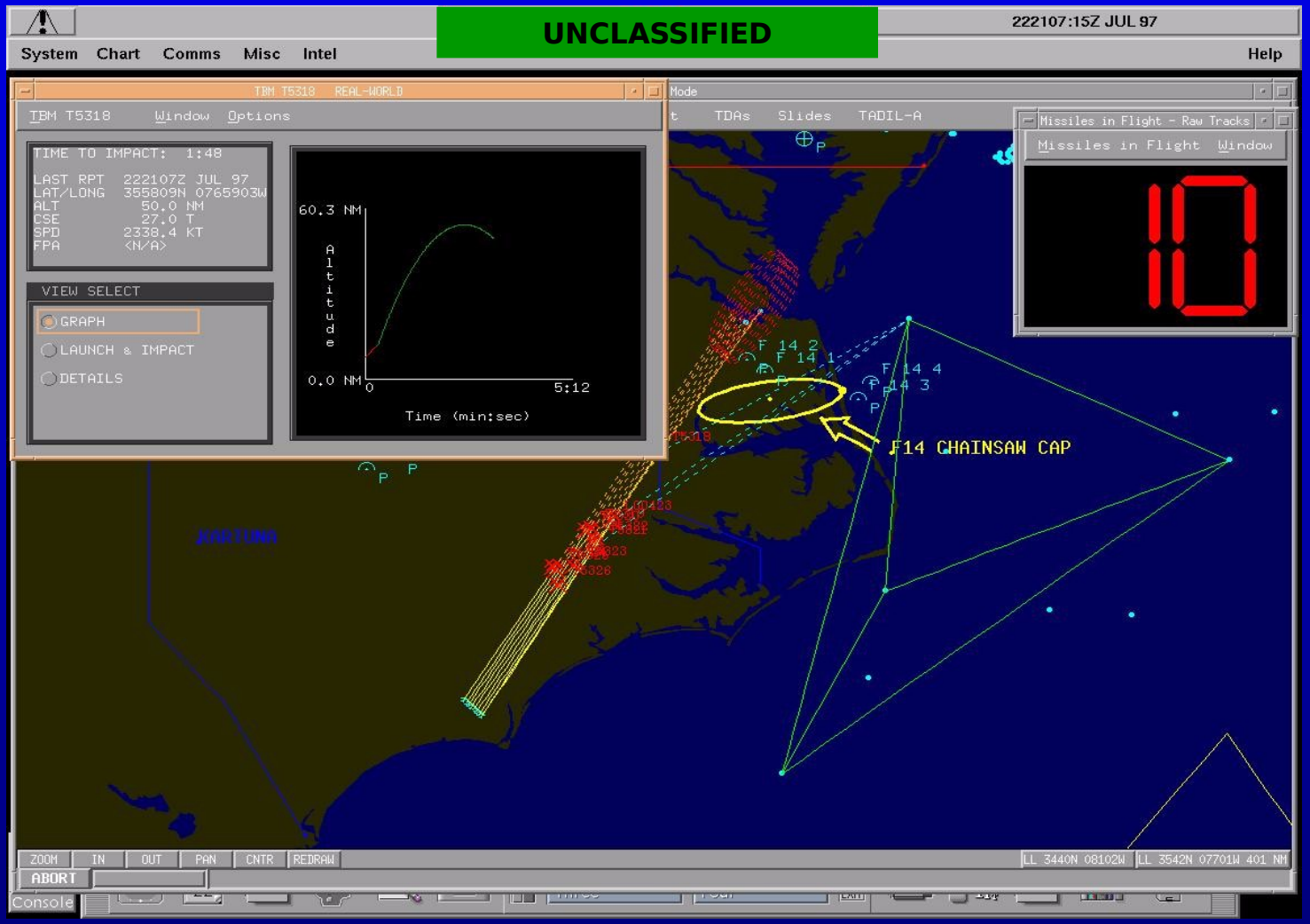
# Single Supporting Data Source



# Common Operational Picture –
## *Real-Time Video, Integrated Imagery*



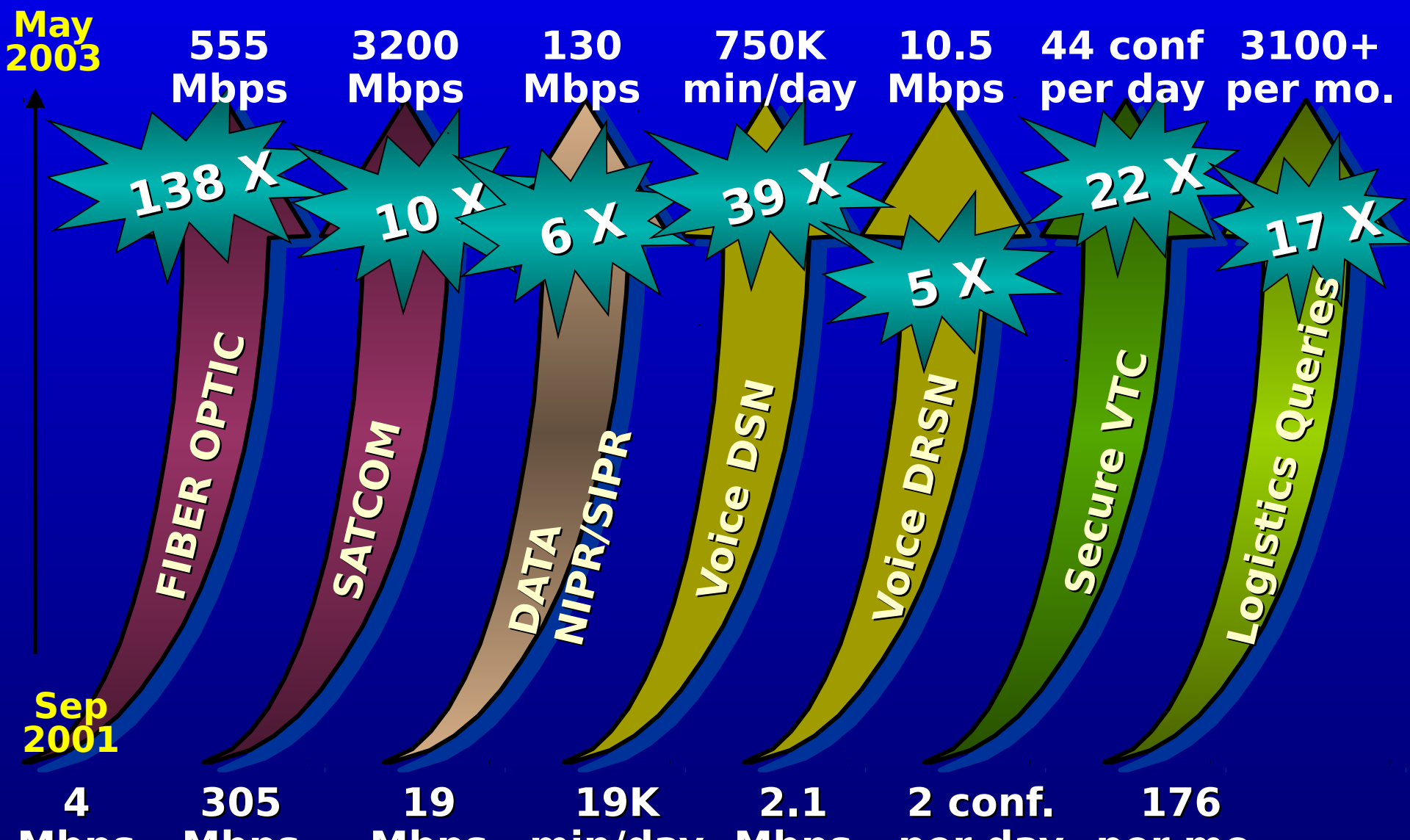
# Common Operational Picture –
## *Theater Ballistic Missile, Integrated Intelligence*



# Operation Iraqi Freedom Successes

- ***First*- All-Service and SOF, Red, Blue, & Intel fused picture.**
- ***First*- Large-scale use of secure satellite phones in a combat environment.**
- ***First*- Extensive coalition automated information sharing exchange.**
- ***First*- Desktop collaboration tools used for joint C2.**
- ***First*- Widespread use of VTC as a C2 system.**
- ***First*- Ubiquitous use of commercial SATCOM to supplement military SATCOM.**
- ***First*- Extensive coordinated use of UAVs.**
- ***First*- Real time in-transit/asset visibility.**

# Operation Iraqi Freedom Communications Trends

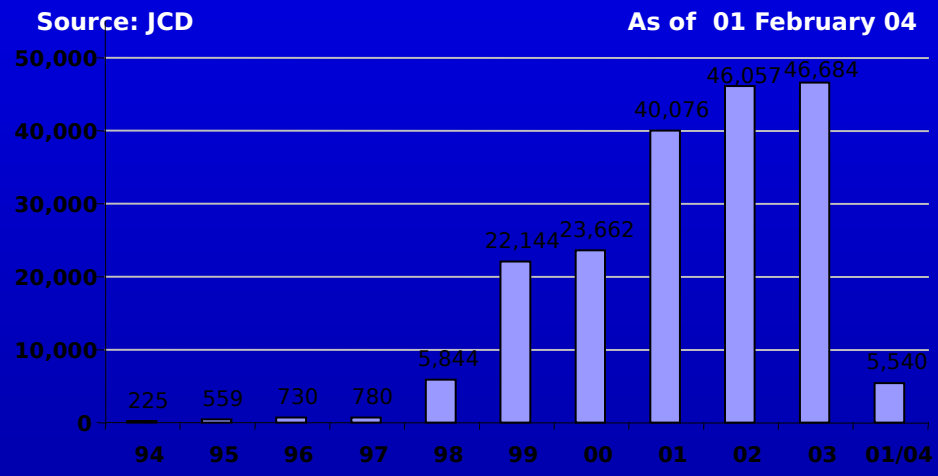


# ODS/OIF Comparisons

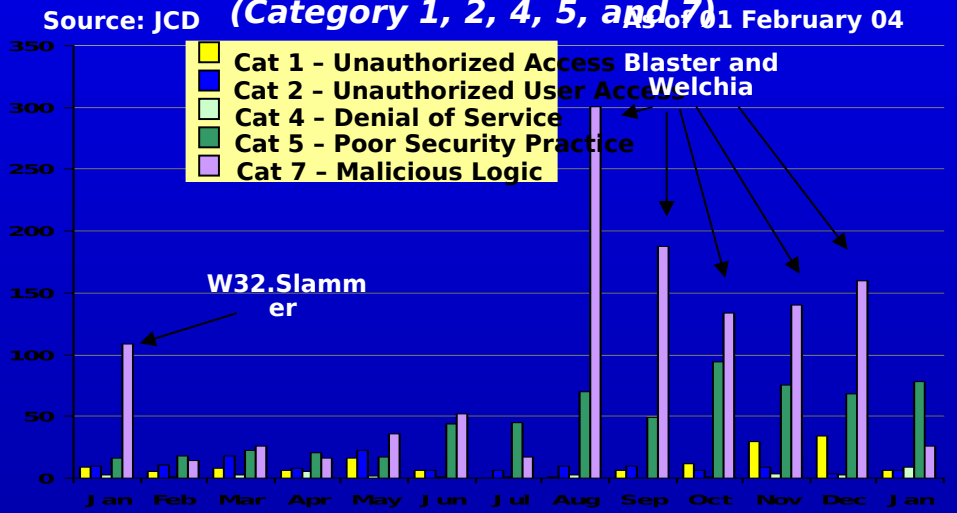
| | Knowledge | Speed | Precision | Lethality (Air 2 Gnd OPS) |
|---|---|---|---|---|
| **ODS** | 3200 ISR Sortie Hours | 7 Mos Buildup | 10 % PGMs ~ 30 SOF Teams | 10 % Integ Ops 4 Acft/Tgt |
| **OIF** | 1700 ISR Sortie Hours | <3 Mos Buildup | 70 % PGMs ~ 100 SOF Teams | 90 % Integ Ops 1 Acft/4 Tgt |
| **RESULTS** | 3X Info ½ of the Hours ↓ Footprint | ↓ Footprint # Ships Msn Achieve t ↑ Speed of Mnvr | ↓ Precision Decisions ↓ Collat Dam ↑ RQD Ord | ↑ Economy Of Force ↓ Heavy Ord Rqmts |

# Leading CND Security Indicators

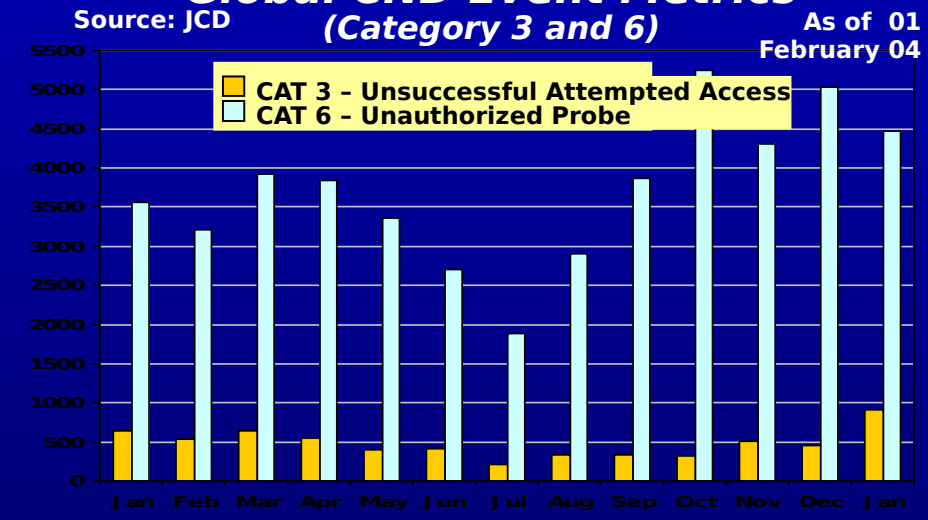
## Detected "Events"
### (DOD Unclassified Network "NIPRNet")



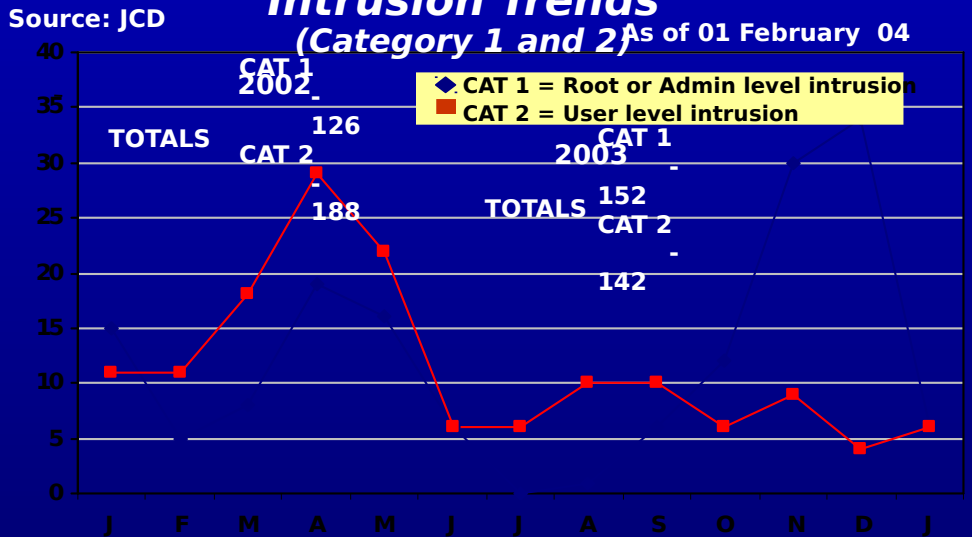

## Global CND Event Metrics
### (Category 1, 2, 4, 5, and 7)




## Global CND Event Metrics
### (Category 3 and 6)




## Intrusion Trends
### (Category 1 and 2)



# Why We're Here Today: The Challenge

- **Current Enterprise-Wide Infrastructure Approaches Are Aging**
  - **Good News:** 27 Releases of Global Command and Control Since 9/11
  - **Bad News:** Insufficiently Scalable, Flexible, Technologically Dated
- **Current Web Services, Enterprise Application Integration, Service-Oriented Architectures Hold Promise**
  - **Good News:** Early Enterprise Efforts Indicate Certain Aspects of Technology are Sufficiently Mature for Broad Application
  - **Bad News:** Lots of Maturation Still Required – Both for the Federal Enterprise to Use and for the Commercial Technology Itself

**"...possibly the single-most transforming thing in our forces will not be a weapons system, but a set of interconnections and a substantially enhanced capability because of that awareness."**

***-- Defense Secretary Rumsfeld***

# The Future

# To Counter the Asymmetric Threat:

# Agile NetCentric Warfare

- Transform Federal Intranets into Service Oriented Architectures
- Publish *all* information as early and as widely as possible
- Empower Users to pull *whatever* they want *whenever* they want
- Distribute Product Management to specialized Communities *but*
- Clearly identify Information Producers to the Enterprise
- Exploit Market Mechanisms
  - Visibility
  - Supply & Demand
  - Agility
  - ROI Metrics

**"Boundaryless Information Flow"**

**Scale: Several Million Users; Tens of Thousands of Information Services**

# Keys to Agility

1st - **Comprehensive, accurate, shared Situation Awareness to enable self-synchronization**

2nd - **Mobility and "Composability" to rapidly reconfigure forces *and* supporting information capabilities**

3rd - **Service Oriented Architecture (SOA)**

- **Modular, loosely coupled → Rapidly reconfigurable**
- **Ubiquitous user access → Collaboration**

*Result:*

*Dramatically accelerated organizational learning* cycle!*

***Responders (Users) exhibit rapid behavior change in combat (continuous experimentat**

# The *New* Assumptions

- **Industrial Age (System-centric)**
  - Clear lines of authority
  - Limited Scope (Finite system boundaries and user population)
  - Known, relatively static requirements
  - Predictable future (stable Business environment and standard processes)
  - Deduce designs from high level abstractions and test effectiveness with small-scale experimentation
- **Information Age (Net-centric)**
  - Boundless information space with no single controlling authority
  - Highly dynamic requirements w/ many unknowns
  - Marginally predictable near term future
  - Many users engaging in unpredictable ways at unpredictable intervals
  - Highly, Dynamically Interconnected

**Designs *must*:**

1. Derive from massive simulations and ongoing real world observations
2. Be agile before and after fielding in response to new conditions

# The *New* Imperatives

**How to Improve Design of large, complex Net-centric capabilities?**

**How to Lower Risks inherent in designing and deploying large, complex Net-centric capabilities?**

Shape evolution of Enterprise IT

*Vice*

Build systems

# Net-centric Characteristics

- Heterogeneous
  - **Variety is essential and inevitable – basis for healthy evolutionary growth and survival within dynamic threat environment**
- Parallel
  - **Multiple implementation and concurrent use of components and processes – increases speed and provides fail-over capability**
- Market-driven
  - **Emphasizes Market principles vice top down direction to optimize – "Survival of the fit" (v. selection of the fittest from a single perspective)**
  - **Developers "experiment early and often" to find the right niche**
- Agile and adaptable
  - **Capable of rapid reconfiguration to meet new and unanticipated requirements or circumvent disruption**
  - **Expedient task-oriented collaborations vice static bureaucracy**

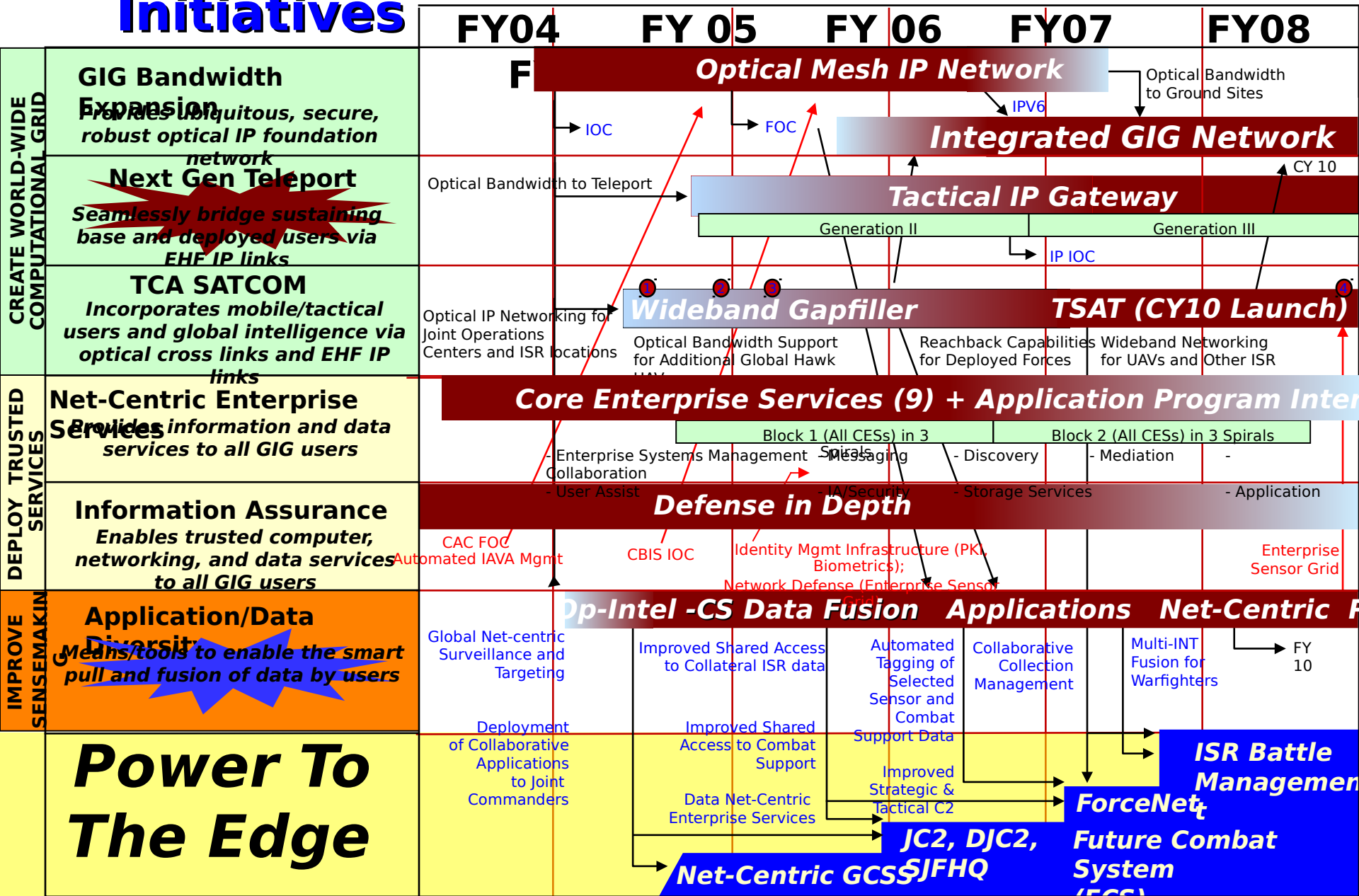
# The Solution: A Layered Architecture for DoD's Future

Standards Maturity

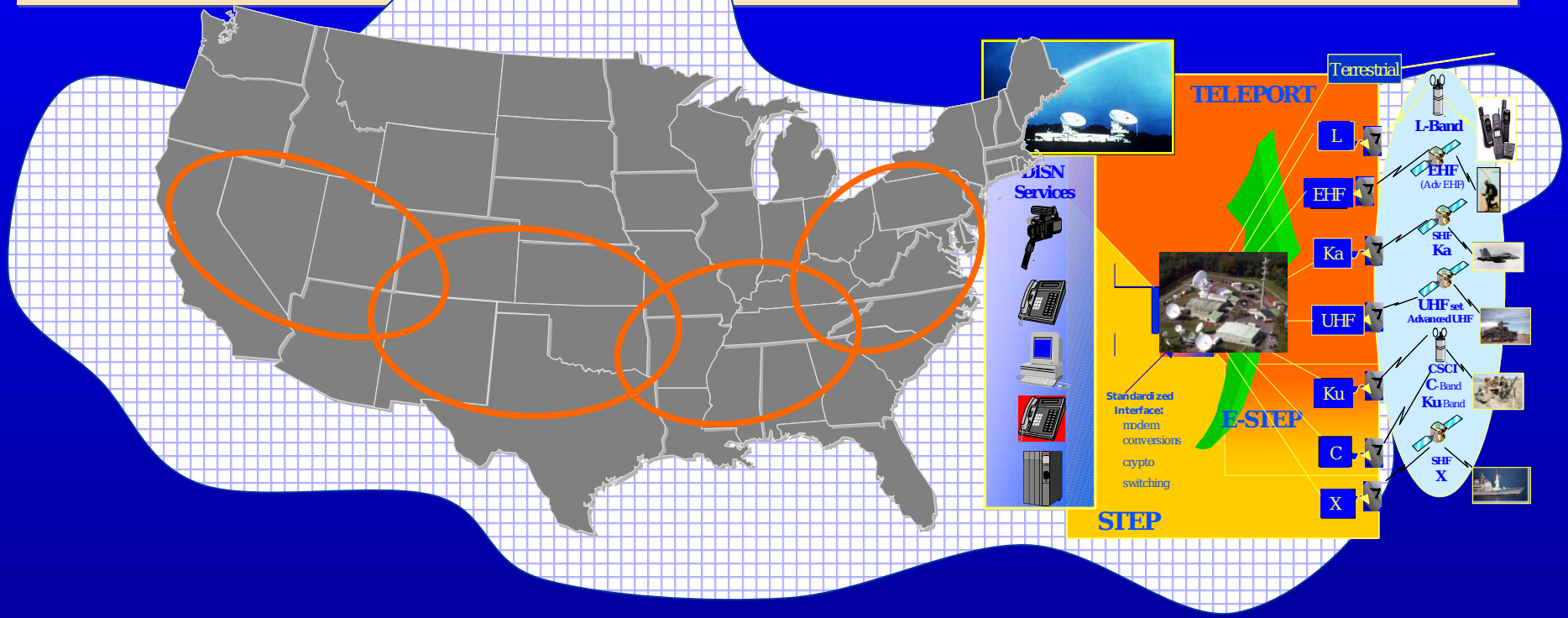
1. Comms:
   IPv4 -> IPv6
2. Applications, Storage, ESM, IA, User Assistance:
   Posix, Linux (Platform APIs)… -> Open Grid Services
3. Directory, Discovery, Mediation, Messaging, Collaboration (Video, Audio, Data):
   APIs….-> Web Services

Standards-Based Service Definitions
- Network Address(es)
- Payload Information (Data & Service)
- Descriptor Attributes (e.g. Service Quality, Security, Version #)

# DISA Contributors to Key Net-Centric Initiatives


FY04
FY 05
FY 06
FY07
FY08
CREATE WORLD-WIDE COMPUTATIONAL GRID
DEPLOY TRUSTED SERVICES
IMPROVE SENSEMAKING
GIG Bandwidth Expansion
Provides ubiquitous, secure, robust optical IP foundation network
Next Gen Teleport
Seamlessly bridge sustaining base and deployed users via EHF IP links
TCA SATCOM
Incorporates mobile/tactical users and global intelligence via optical cross links and EHF IP links
Net-Centric Enterprise Services
Provides information and data services to all GIG users
Information Assurance
Enables trusted computer, networking, and data services to all GIG users
Application/Data Diversity
Means/tools to enable the smart pull and fusion of data by users
Power To The Edge
Optical Mesh IP Network
Optical Bandwidth to Ground Sites
IPV6
IOC
FOC
Integrated GIG Network
Optical Bandwidth to Teleport
Tactical IP Gateway
CY 10
Generation II
Generation III
IP IOC
Optical IP Networking for Joint Operations Centers and ISR locations
Wideband Gapfiller
TSAT (CY10 Launch)
Optical Bandwidth Support for Additional Global Hawk UAV
Reachback Capabilities for Deployed Forces
Wideband Networking for UAVs and Other ISR
Core Enterprise Services (9) + Application Program Inter
Block 1 (All CESs) in 3 Spirals
Block 2 (All CESs) in 3 Spirals
- Enterprise Systems Management
- Messaging
- Discovery
- Mediation
- Collaboration
- User Assist
- IA/Security
- Storage Services
- Application
Defense in Depth
CAC FOC
Automated IAVA Mgmt
CBIS IOC
Identity Mgmt Infrastructure (PKI, Biometrics);
Network Defense (Enterprise Sensor Grid)
Enterprise Sensor Grid
Op-Intel -CS Data Fusion
Applications
Net-Centric
FY 10
Global Net-centric Surveillance and Targeting
Improved Shared Access to Collateral ISR data
Automated Tagging of Selected Sensor and Combat Support Data
Collaborative Collection Management
Multi-INT Fusion for Warfighters
Deployment of Collaborative Applications to Joint Commanders
Improved Shared Access to Combat Support
Improved Strategic & Tactical C2
Data Net-Centric Enterprise Services
ISR Battle Management
ForceNet
JC2, DJC2, SJFHQ
Future Combat System (FCS)
Net-Centric GCSS

# Networks




**(Proposed) Objective DISN Services:**

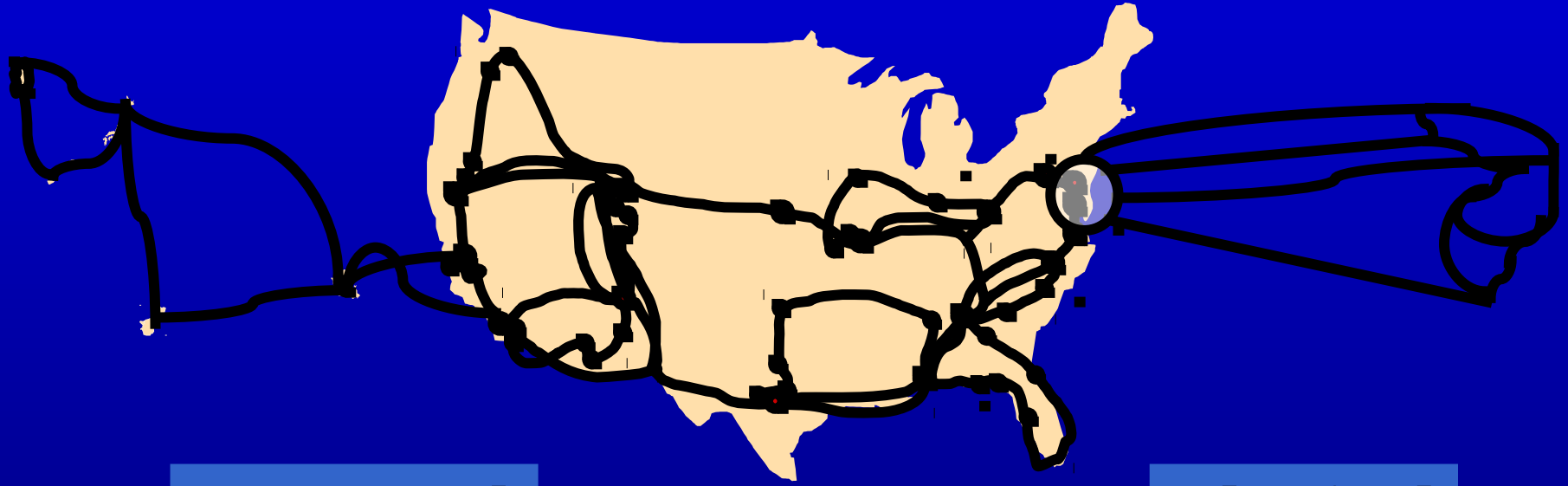
- *SLA-based (Converged) Voice, Video, Data Services*
  - *End-to-End Qos*
  - *Dynamic Provisioning, Self-Healing, Self-Configuring (e.g. Mesh Networks)*
  - *Cacheing, Content Delivery, MultiCast,*
  - *"Bandwidth on Demand"*
  - *Effective, Efficient Acquisition &*

# GIG-BE

## iquitous, Secure, Robust, Optical IP Terrestrial Netwo

**FOC Sep 05**

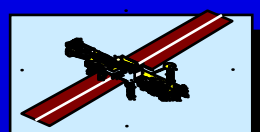
**100 Locations Worldwide**



***Increased Bandwidth*** **&** ***Physical Diversity***

**Optical Switching**
**Up to N x OC-192**

# Teleport



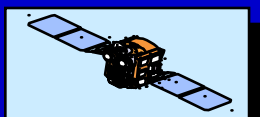
Protected

Pathfinder

MILSTAR (MDR - 02+)

ADVANCED EHF (Protected/Survivable)

Gapfiller WB (Mil Ka)



Wideband

DSCS

DSCS-SLEP

(Capacity & Broadcast)

SHF/ Ka

Future High Cap & Broadcast System

COMMERCIAL (C and Ku and L)

Narrowband

GBS (Hosted on UFO)

UFO

Advanced UHF (Mobile User Services)

Tactical Terminals

SMART-T (EHF)

SCAMP (EHF)

NESP Follow-On (EHF)

LMST

GMT

Army Wideband Tactical

Teleport

99 01 03 05 07 09 11 13

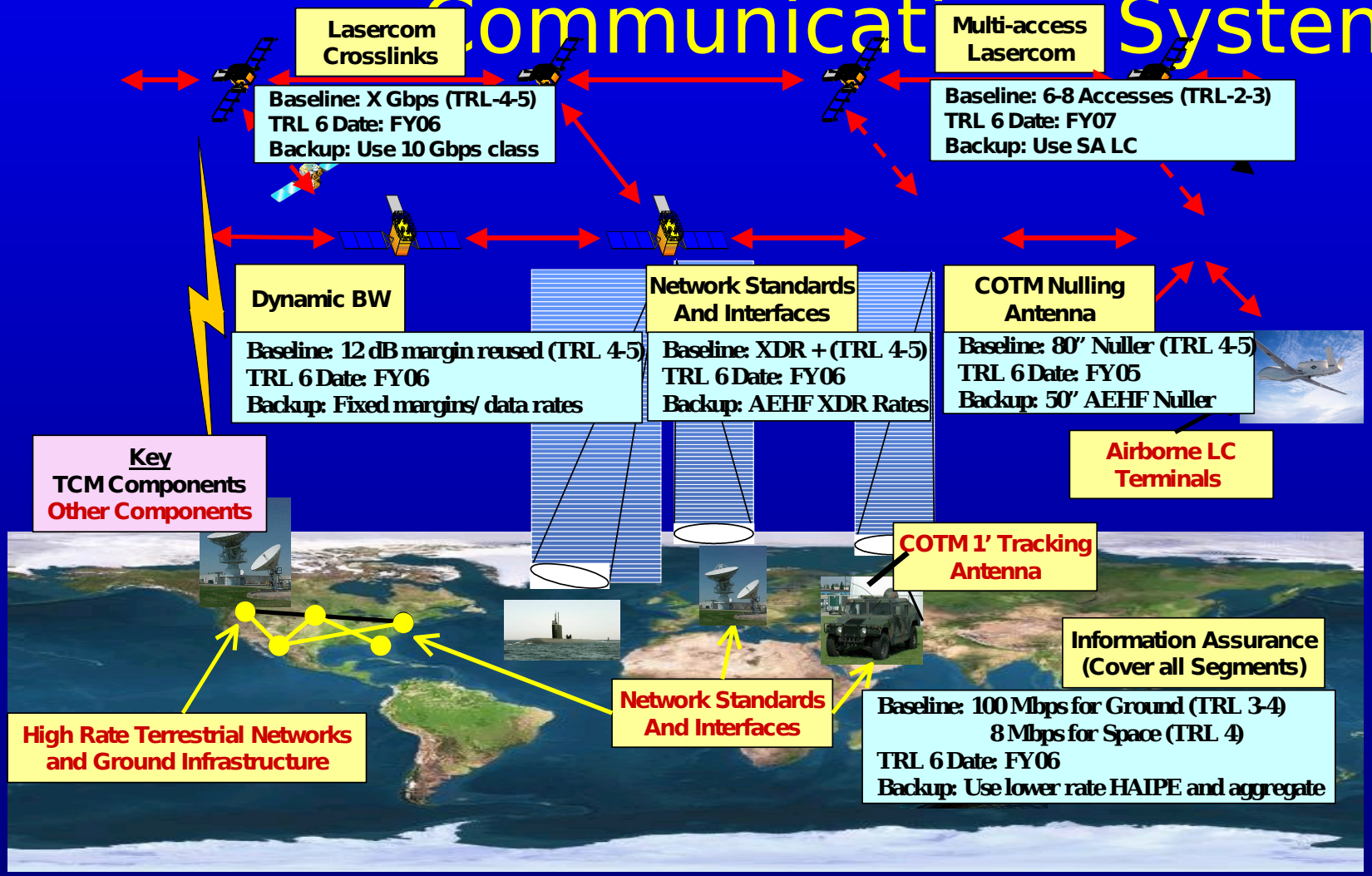
**STEP**
X

**GEN I**
C/Ku
UHF

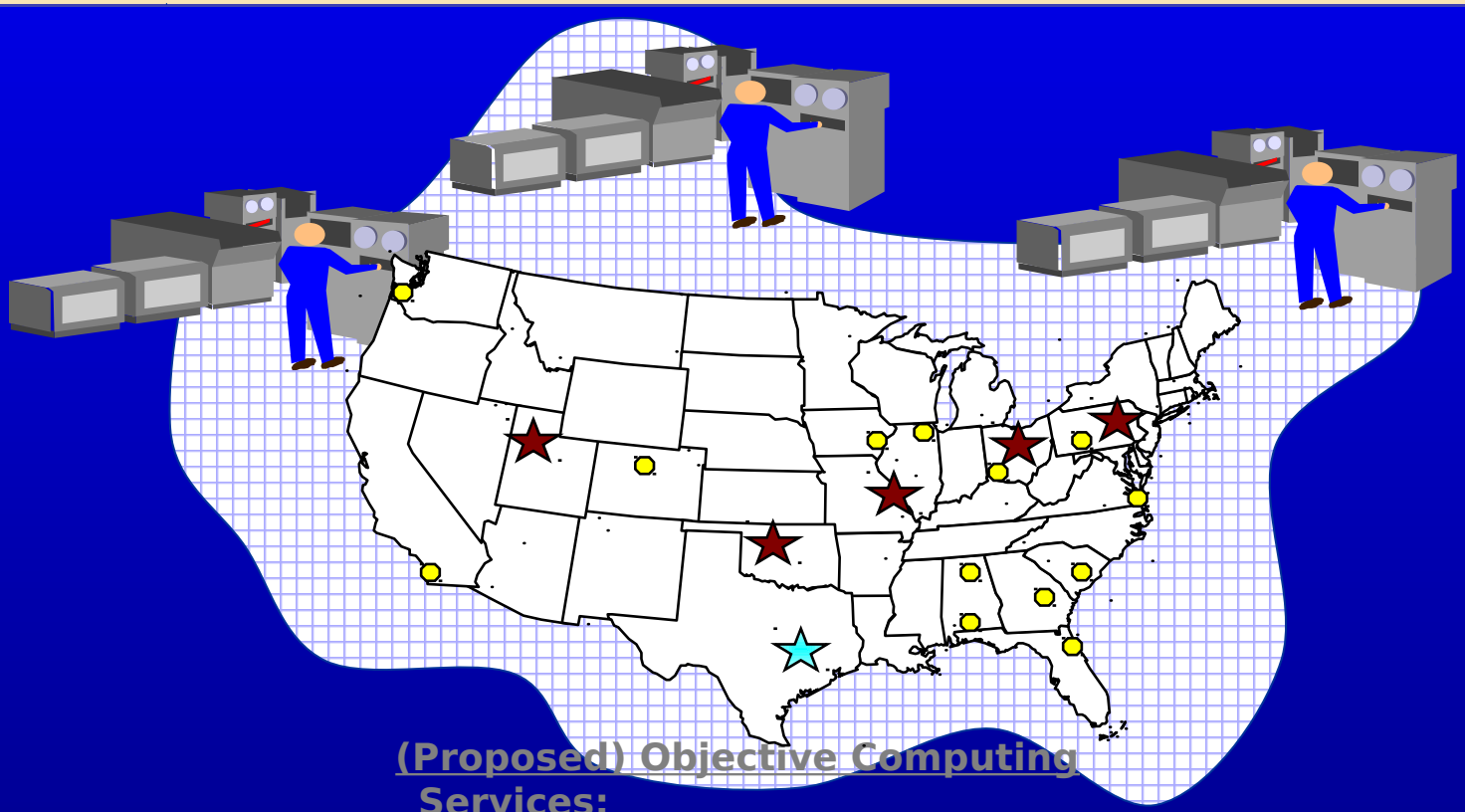
**GEN II**
Ka EHF L
HF
IP

**GEN III**
Adv EHF Future Wideband

# Transformational Communications System


Lasercom Crosslinks
Baseline: X Gbps (TRL-4-5)
TRL 6 Date: FY06
Backup: Use 10 Gbps class
Multi-access Lasercom
Baseline: 6-8 Accesses (TRL-2-3)
TRL 6 Date: FY07
Backup: Use SA LC
Dynamic BW
Baseline: 12 dB margin reused (TRL 4-5)
TRL 6 Date: FY06
Backup: Fixed margins/ data rates
Network Standards And Interfaces
Baseline: XDR + (TRL 4-5)
TRL 6 Date: FY06
Backup: AEHF XDR Rates
COTM Nulling Antenna
Baseline: 80" Nuller (TRL 4-5)
TRL 6 Date: FY05
Backup: 50" AEHF Nuller
Airborne LC Terminals
Key
TCM Components
Other Components
COTM 1' Tracking Antenna
Information Assurance (Cover all Segments)
Baseline: 100 Mbps for Ground (TRL 3-4)
8 Mbps for Space (TRL 4)
TRL 6 Date: FY06
Backup: Use lower rate HAIPE and aggregate
Network Standards And Interfaces
High Rate Terrestrial Networks and Ground Infrastructure

# Hosting

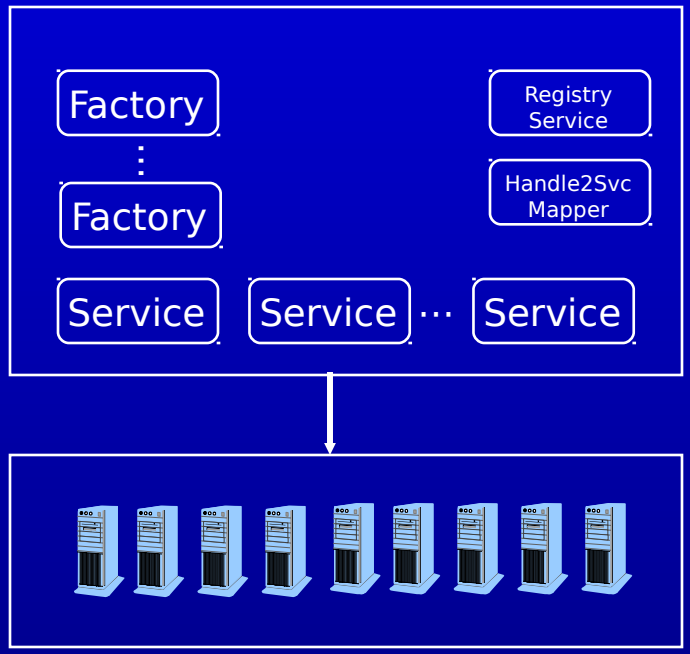


**(Proposed) Objective Computing Services:**

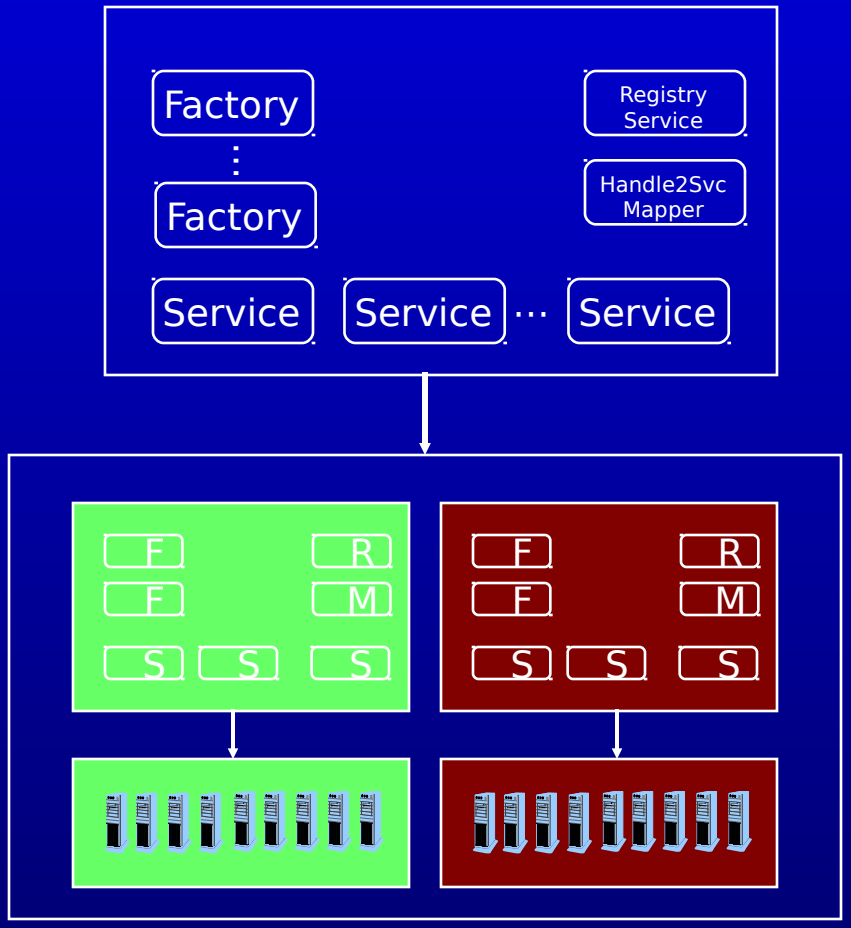
- ***SLA-based MIPS and Bytes***
  - ***Capacity on Demand (e.g. Grid & Autonomic Computing)***
  - ***Dynamic Storage Provisioning***
  - ***Reliable Data Distribution and Replication***
  - ***Effective, Efficient Acquisition***

# Gridded Services Environment: Computing on Demand

## Simple Hosting Environment

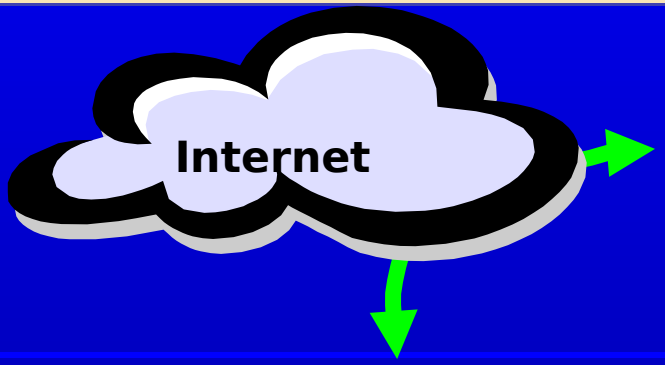


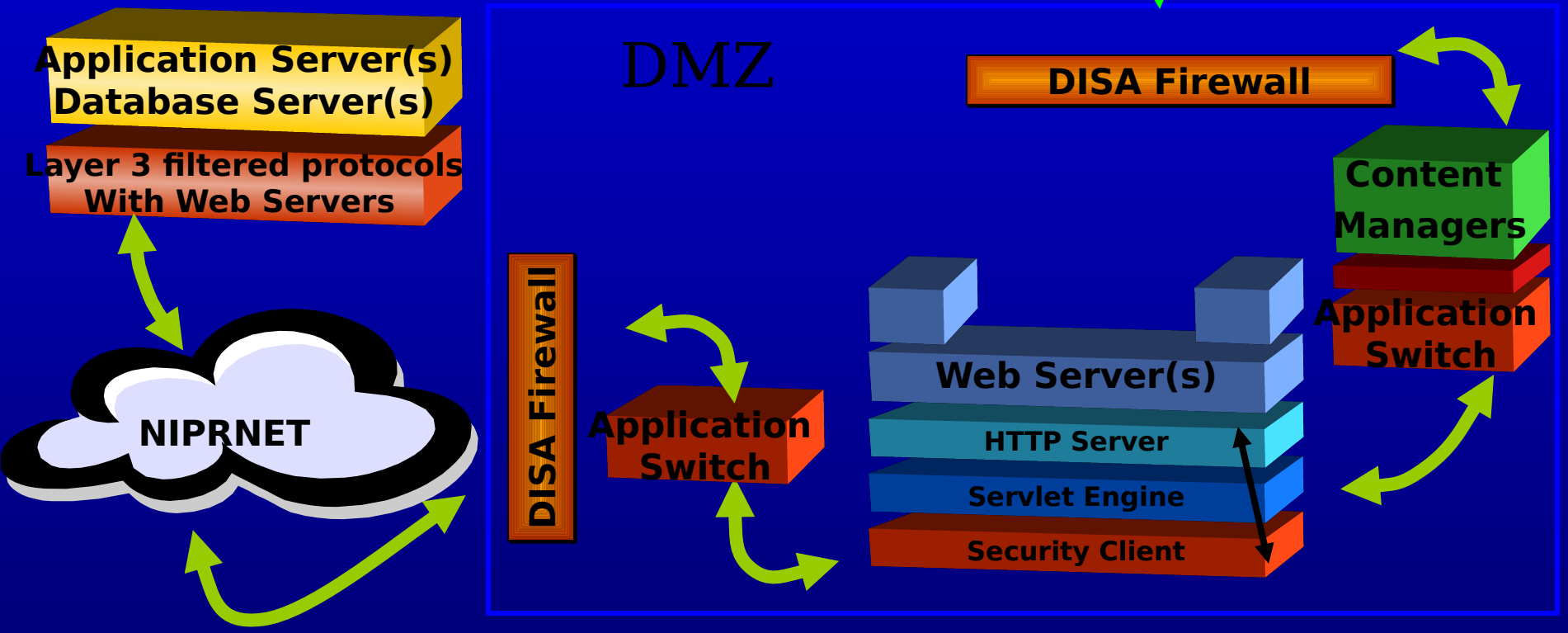

## Virtualized Hosting Environment



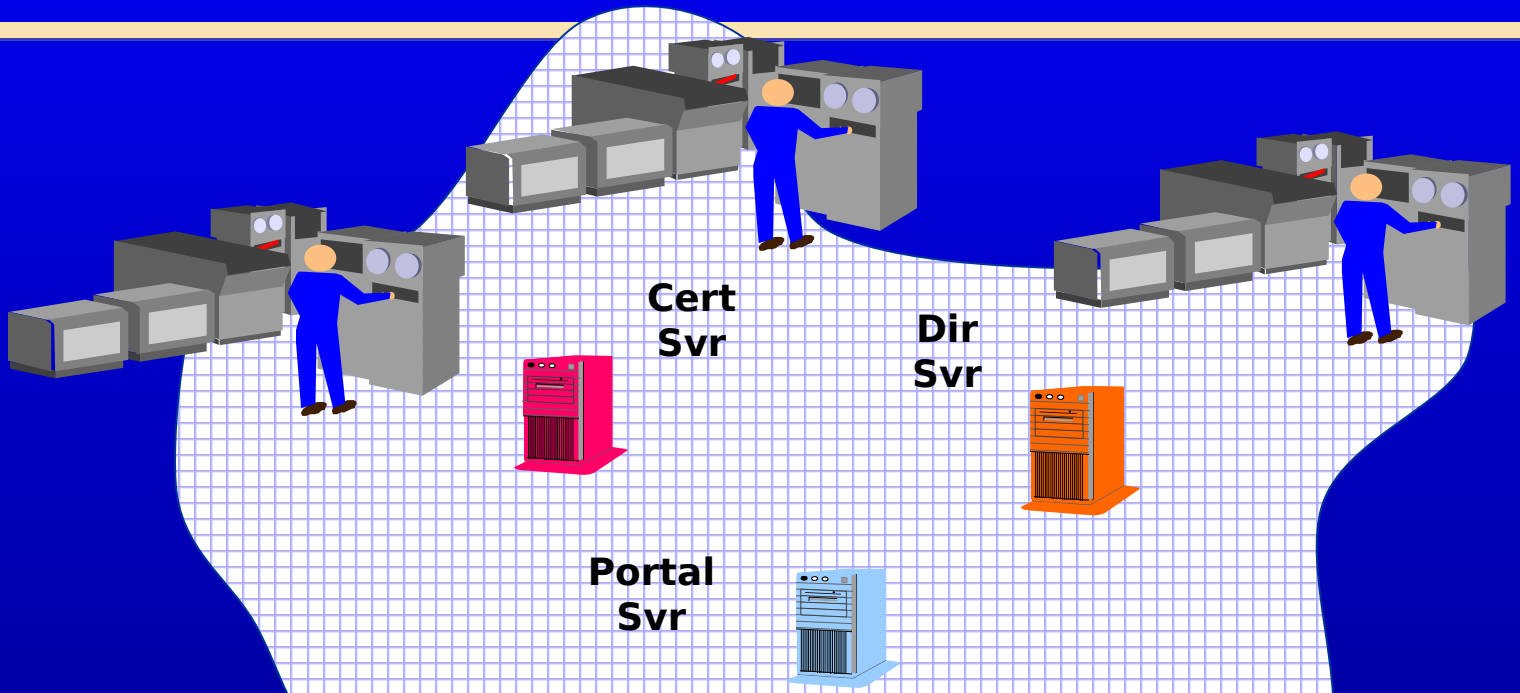
# The Department's DMZ

- Response to Code Red
- Solution worked through Dell
- 60 applications now in DMZs





# Infrastructure



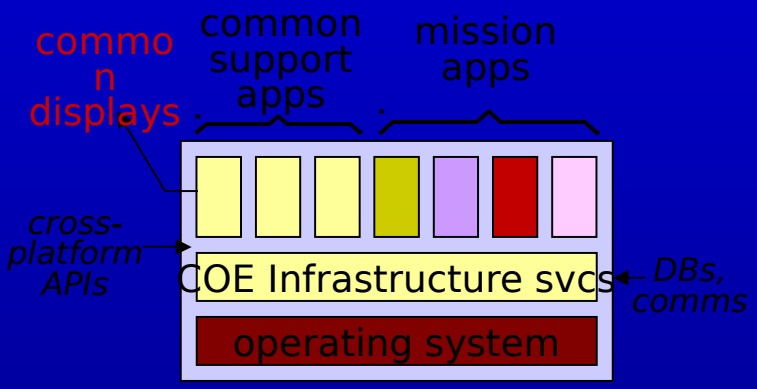

**(Proposed) Objective Enterprise Services:**

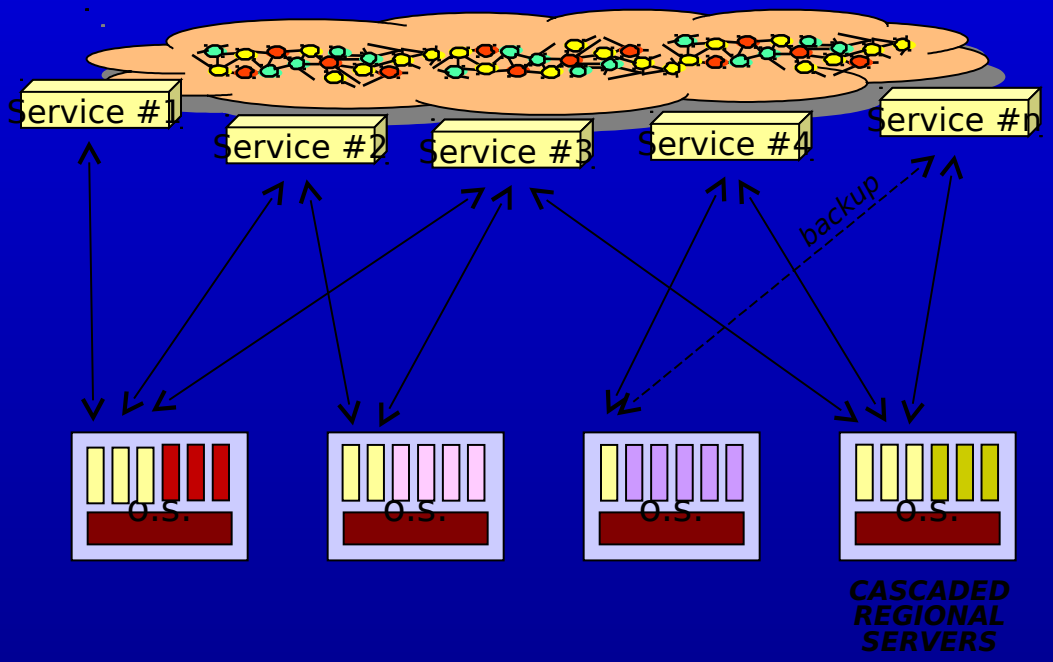
- ***Building Blocks for Secure Integration of Applications and Data Sources***
  - ***Identification & Authentication***
  - ***Directory***
  - ***Messaging & Transactions***
  - ***Information Management (Discovery, Access, Dissemination)***

# COE => NCES: A Paradigm Shift

***The COE was all about SOFTWARE PORTABILITY and REUSE***

***The NCES core enterprise services are about easily connecting to net-centric services***




**COE perspective:**

plug ‘n play of common applications on a set of common support services

**NCES perspective:**

access to information and services
if & when required
*(via web or download/install)*

# GIG Enterprise Services

Support real-time & near-real-time warrior needs, and business users

**DoD (Title 10)** | **IC (Title 50)**

**Users**

**Business Domains**

- Installation & Environment
- Human Resource Management
- Acquisition
- Strategic Planning & Budget
- Logistics
- Accounting & Finance

**Warfighter Domains**

- Command & Control
- Force Application
- Protection
- Focused Logistics
- Battlespace Awareness

**National Intelligence Domain**

- IC Org Spaces

COI's

Expedient COI's

Cross Domain COI's (e.g. M&S)

**Core Enterprise Services (CES)**

| Application | User Assistant | Storage | Messaging | IA/Security |
|---|---|---|---|---|
| IA/Security | IA/Security | IA/Security | IA/Security | ESM |
| ESM | ESM | ESM | ESM | |

| Discovery | Collaboration | Mediation | Enterprise Service Management (ESM) |
|---|---|---|---|
| IA/Security | IA/Security | IA/Security | IA/Security |
| ESM | ESM | ESM | |

**Transformational Communications (TC) & Computing Infrastructure**

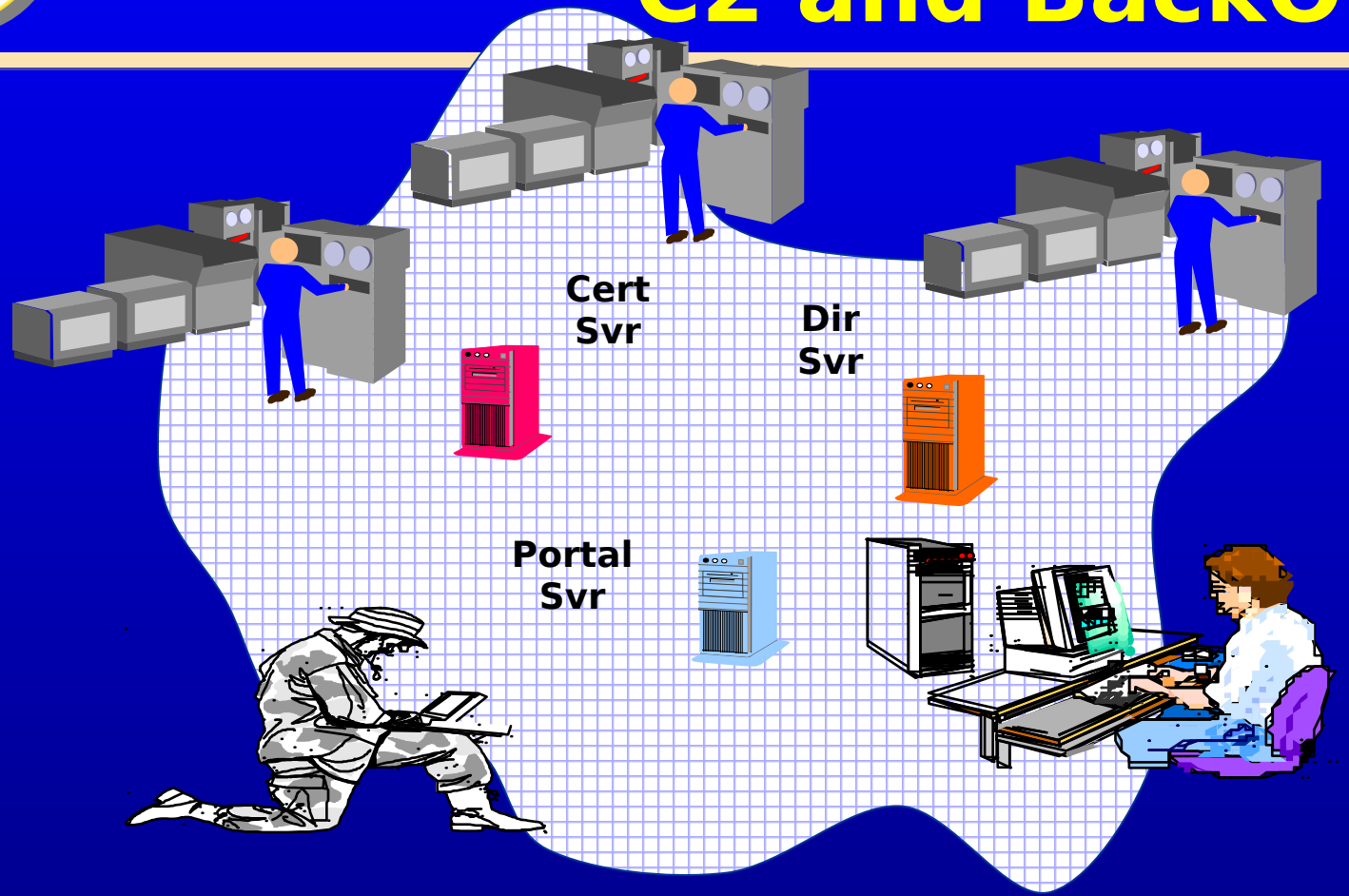
Domain/ COI Capabilities

Levels of Services Above Core Level

ICSIS Community Space

Technical Infrastructure Domain

# Applications… C2 and BackOffice




**(Proposed) Objective Applications & Data Sources**

- ***Community of Interest Functionality***
- ***Secure, Interoperable Plug-n-Play Data Sources and Applications***

# From Systems to Services

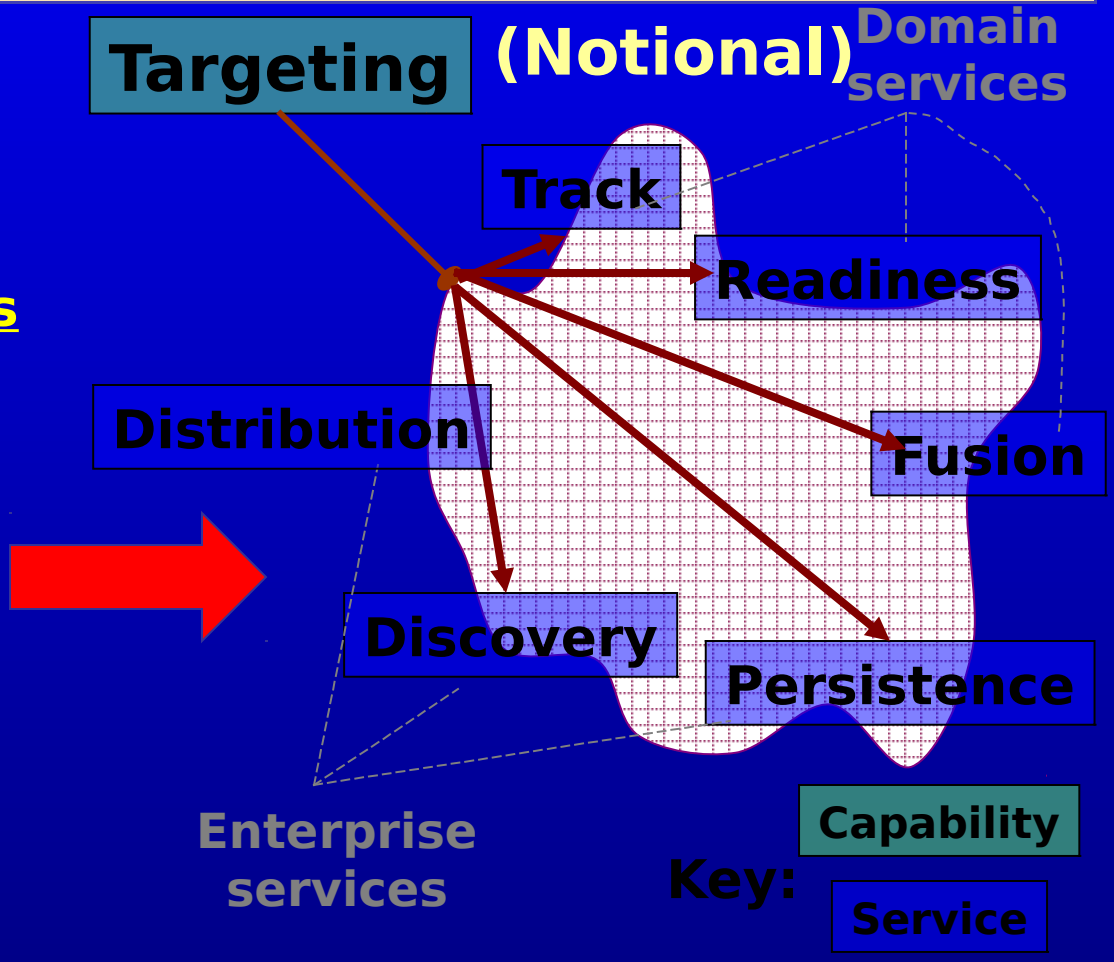
**Today: Systems with Targeting Applications**

**GCCS**

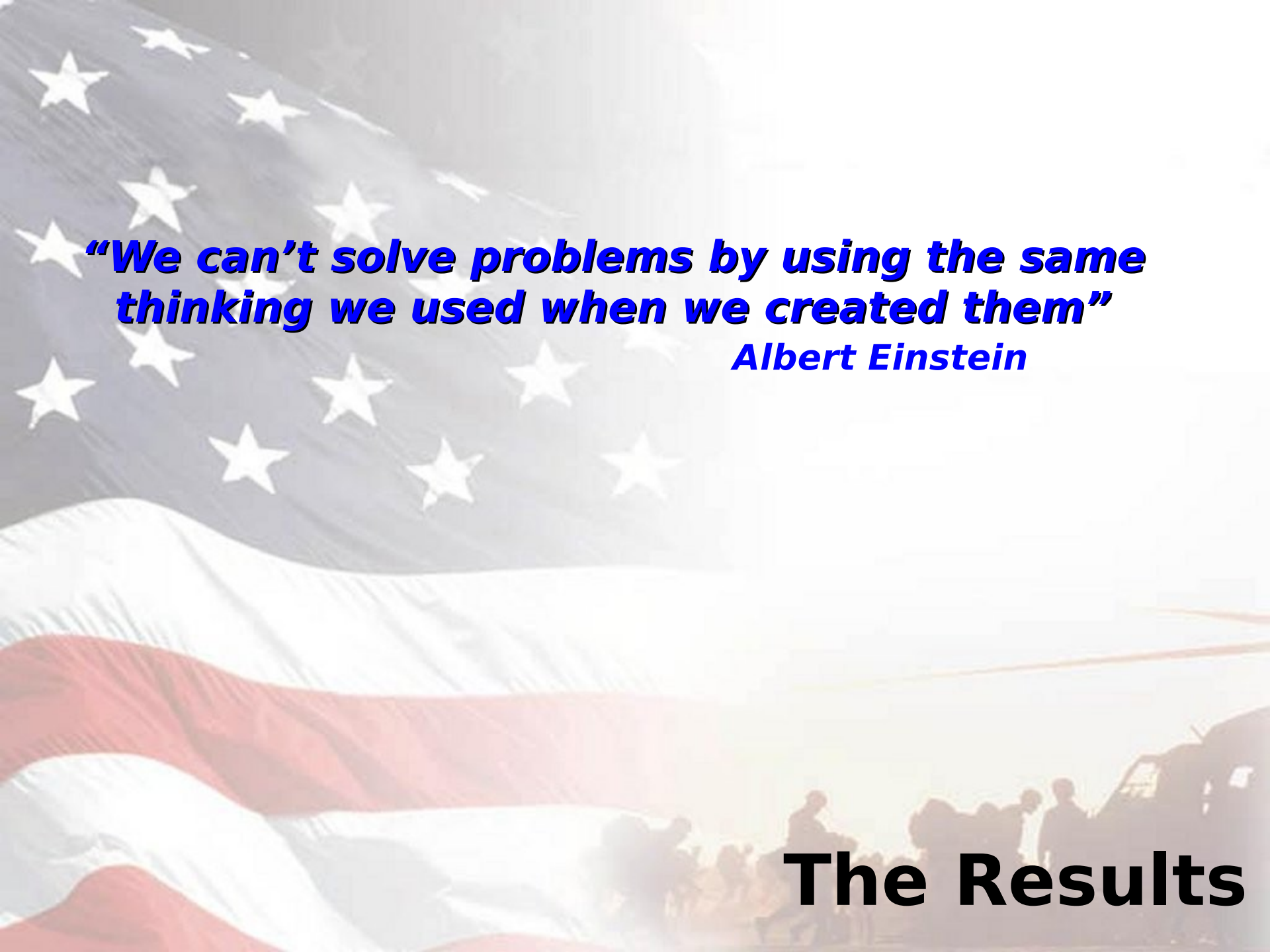
**ABCS**

**GCCS-M**

**TBMCS**




***Capability discovers and uses common***



*“We can’t solve problems by using the same thinking we used when we created them”*

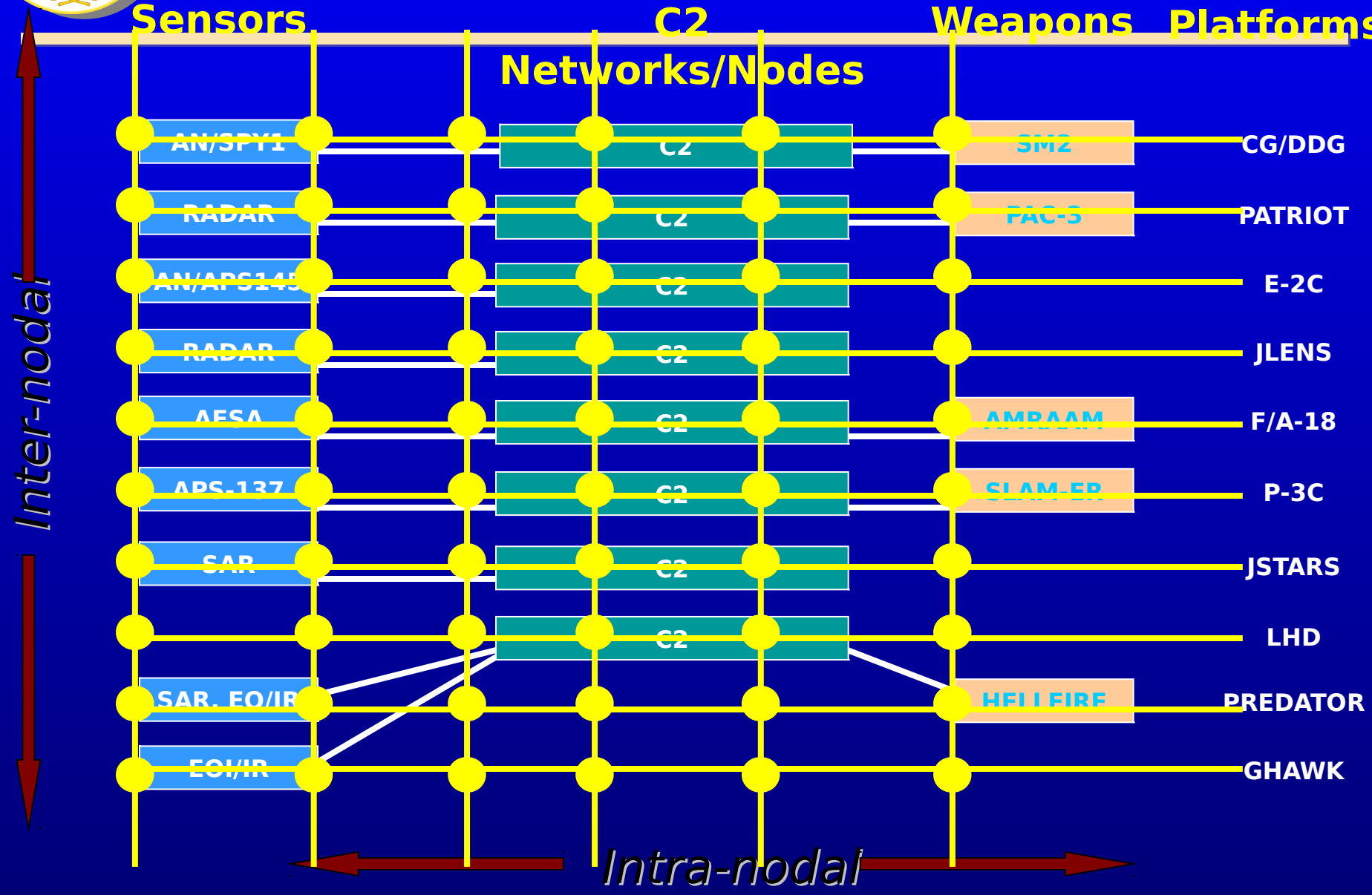
*Albert Einstein*

# The Results

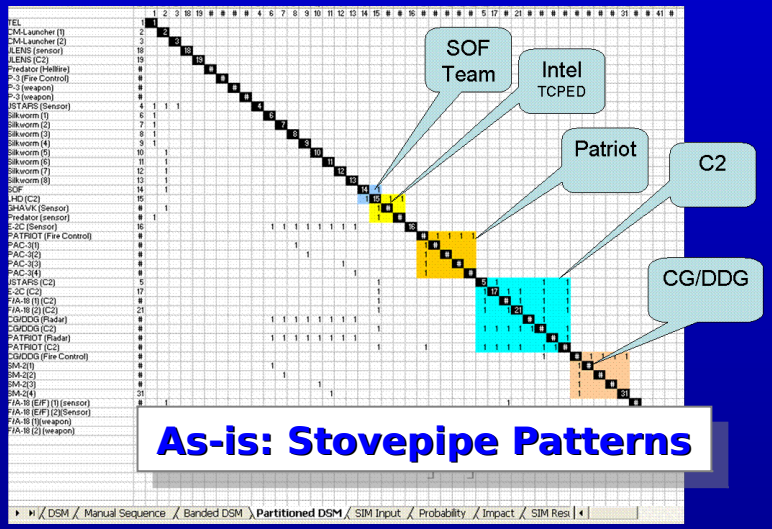
# Apps & Infrastructure with Redundancy (Target d

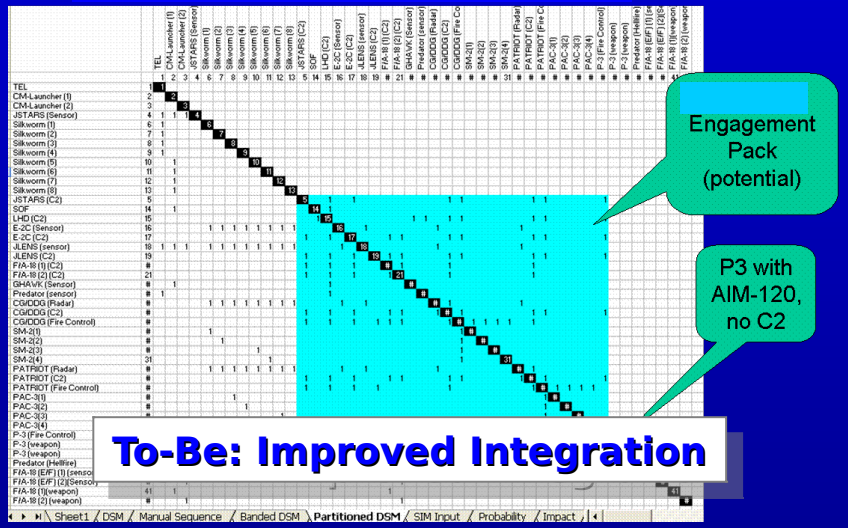
| ASSES | ENGAGE | FIND | FIX | PLAN | TARGET | TRAC |
|---|---|---|---|---|---|---|
| ADMS | AADC | ADMS | ADMS | AADC | AADC | AADC |
| ADOCS | ACDS | ADS | AEHF | AADS | ACDS | ADMS |
| AEHF | ADMS | AEGIS-CDS | BLII | ACDS | ADMS | AEHF |
| ATARS | ADOCS | AEHF | C2P | ADMS | ADOCS | APS |
| BLII | AEGIS-CDS | ATARS | CEC | ADOCS | AEGIS-CDS | BLII |
| C2P | AEHF | AWACS | CHBDL | AEGIS C&D | AEHF | C2P |
| CEC | APS & APS/RDS | BGPHES | CLIP/ADNS | AEHF | AFATDS | CEC |
| CHBDL | AWACS | BLII | CTN | APS | APS | CHBDL |
| CLIP/ADNS | BLII | C2P | CV4027/CSDTS | APS & APS/ | APS & APS/ | CLIP/ADNS |
| CTN | C2P | CEC | DAMS | BLII | AWACS | CTAPS |
| DSCS | CEC | CGS | DSCS | C2P | BLII | CTN |
| DWTS | CHBDL | CHBDL | DWTS | CAFWSP | C2P | DACT/C2PC |
| EHF MDR | CLIP/ADNS | CLIP/ADNS | EHF MDR | CEC | CEC | DAMS |
| GBDL | CTN | CRYPTO DS | EPLRS | CHBDL | CHBDL | DIWS-N |
| GBS | DACT/C2PC | CTN | GBDL | CID (ACTD) | CLIP/ADNS | DSCS |
| GCCS-M | DIWS-N | CTT3/JTT | GBS | CLIP/ADNS | COMBAT ID (MKXII IF | DWTS |
| GHAWK | DSCS | DSCS | GCCS-M | COMBAT ID | CTAPS | EHF MDR |
| GPS | DWTS | DSP | GPS | CTAPS | CTN | EPLRS |
| GPS Modernization | E-2C | DWTS | GPS Modernization | CTN | DACT/C2PC | GBDL |
| INMARSAT B | EHF MDR | EHF MDR | HaveQuick | CV4027/CS | DAMS | GBS |
| IRIDIUM | GBDL | EPLRS | IMMACCS (MCSIT) | CV-TSC | DIWS-N | GPS |
| ISNS | GBS | FDS | INMARSAT B | DACT/C2PC | DSCS | GPS Modernization |
| JTIDS | GCCS-M | GBDL | IRIDIUM | DAMS | DWTS | HaveQuick |
| JTT | GPS | GBS | ISNS | DMIF | E-2C | IDASC |
| JTT CIB-M | GPS Modernization | GHAWK | JTIDS | DSCS | EHF MDR | INMARSAT B |
| Link 11 Tadil B | HaveQuick | GPS | JTT CIB-M | DWTS | EPLRS | IRIDIUM |
| Link 16 | IDASC | GPS Modernization | JTW | EHF MDR | GBDL | ISNS |
| Link 22 | INMARSAT B | HaveQuick | LAWS | EPLRS | GBS | JMPS |
| MIDS | IRIDIUM | INMARSAT B | Link 11 Tadil B | ESRP | GPS | JSIPS-N |
| NFCS | ISNS | IRIDIUM | Link 16 | GBDL | GPS Modernization | JTIDS |
| NMCI | JTIDS | ISNS | Link 22 | GBS | HaveQuick | JTW |
| NOC | JWCS | IUSS | Link 4A | GCCS-M | IDASC | Link 11 Tadil B |
| NTDS | LAWS | JTIDS | Link 4C | GHAWK | INMARSAT B | Link 16 |
| Predator | Link 11 Tadil B | Link 11 Tadil B | MIDS | GPS | IRIDIUM | Link 22 |
| PSC-5 | Link 16 | Link 16 | NMCI | GPS Moderr | ISNS | MIDS |
| SBMCS | Link 22 | Link 22 | NOC | HaveQuick | JMPS | NITES |
| SCAMP | Link 4A | Link 4A | NTDS | INMARSAT I | JSIPS-N | NMCI |
| SHARP | Link 4C | Link 4C | PLRS | IRIDIUM | JTIDS | NOC |
| SHF SATCOM | MIDS | MIDS | PSC-5 | ISNS | JTW | NTCSS |
| SIDS | NFCS | NFCS | REDS | JFN | JWCS | NTDS |
| SINCGARS | NMCI | NMCI | SARTIS | JMPS | Link 11 Tadil B | PLRS |
| S-TADIL J/A | NOC | NOC | SBMCS | JSIPS-N | Link 16 | PSC-5 |
| TARPS | NTDS | NTDS | SCAMP | JTIDS | Link 22 | PTW |
| TBMCS | PSC-5 | PLRS | SHF SATCOM | JTRS w/ADNS | Link 4A | SBMCS |
| TSS | REDS | PSC-5 | SINCGARS | JTT | Link 4C | SCAMP |
| WSC-6 (V) 5 | S-3B | Predator | S-TADIL J/A | JTT CIB-M | MIDS | SHF SATCOM |
| WSC-8 | SBMCS | PSC-5 | TARPS | JTW | NFCS | SINCGARS |
| | SCAMP | SBMCS | TBMCS | Link 11 Tadil B | NITES | S-TADIL J/A |
| | SHF SATCOM | SCAMP | TESS | Link 16 | NMCI | TAMPS |
| | SINCGARS | SHF SATCOM | TSS | Link 22 | NOC | TBMCS |
| | S-TADIL J/A | SINCGARS | WSC-6 (V) 5 | Link 4A | NTCSS | TSS |
| | TBMCS | SONAR | WSC-8 | Link 4C | NTDS | TTWCS |
| | TSS | SSEE Inc E/COBLU | | MEDAL | PLRS | TWCS |
| | TWCS | SSIP | | METMF(R) | PSC-5 | WSC-6 (V) 5 |
| | WSC-6 (V) 5 | S-TADIL J/A | | MIDS | PTW | WSC-8 |
| | WSC-8 | SURTASS | | NEP | | |
| | | TBMCS | | NFCS | | |
| | | TSS | | NFN | | |
| | | TUAV | | NITES | | |
| | | WSC-6 (V) 5 | | NMCI | | |
| | | WSC-8 | | NOC | | |
| | | | | NSS | | |
| | | | | NTCSS | | |
| | | | | NTDS | | |
| | | | | OED | | |
| | | | | PLRS | | |
| | | | | Predator | | |
| | | | | PSC-5 | | |
| | | | | PTW | | |
| | | | | SBMCS | | |
| | | | | SCAMP | | |
| | | | | SHF SATCOM | | |
| | | | | SINCGARS | | |
| | | | | SMOOS | | |
| | | | | S-TADIL J/A | | |
| | | | | TAMPS | | |
| | | | | TARPS | | |
| | | | | TAWS | | |
| | | | | TBMCS | | |
| | | | | TEDS | | |
| | | | | TES-N | | |
| | | | | TESS | | |
| | | | | TSS | | |
| | | | | TTWCS | | |
| | | | | UOC | | |
| | | | | WSC-6 (V) 5 | | |
| | | | | WSC-8 | | |

# Distributed Services Capabilities



# Integration Pattern Emergence



# Illustrative Results

Increased combat reach in selected scenarios:

- **40% more TAMD kills**
- **50% reduction in number of leakers**
- **100% increase in engagement envelope**
- **Up to ten-fold increase in overland percent area protected**

Most significant benefits realized when ALL combat reach capabilities implemented

# Implications of NetCentricity

| | 5 Years | 10 Years |
|---|---|---|
| Technical | First emergence of component-based capabilities in place with plug-n-play | Dynamically composeable mission critical threads |
| | Fixed compute platforms & host runtimes; dynamic work flow for mostly non-mission-critical business processes | Grid Computing; dynamic capacity allocation causes server platforms to disappear into "grid"; dynamic work flow for all DoD business processes |
| | B/W & compute capacity high @ operational, strategic levels of war; challenge remains at tactical | Capacity no issue |
| | MLS an issue | MLS enabled by grid |
| | Complexity increases while tech stabilizes & commoditizes | Abstraction & hiding reduce complexity via layered services approach |
| Social | Tactical user remains "have not" | Hierarchy collapses in terms of IT capacity & capability |
| | Differentiators viewed as important at infrastructure service levels; some "hot" channel providers (data and applications) | Differentiators based solely on content and quality of data and applications |
| | DoD providers maintain shared infrastructure Intellectual Property (IP) as a differentiator | DoD providers maintain military-unique IP as differentiator |
| Budget | $ allocated along "stove pipe" system lines, although more joint capabilities | Dynamic allocation of $ Based on PEO/PM performance and associated expertise & experience |
| | Business threads identified to drive transformation but still funded & executed via legacy budget constructs | System thinking morphs to business processes - NOT service stovepipes |
| | Service-based fees applied & well understood/accepted at network level only; fierce in-fighting to maintain separate & distinct infrastructure services | Service-based fees all encompassing; religion from discussion has disappeared as little division remains about how service "dial tone" is rendered |
| Training | More joint but still service-centric & hierarchical | Increased specialization based on mission skills and needs vice service |
| Testing | Capability-based, but preponderance of system-centric thinking & approaches | True plug-n-play |
| | Exhaustive failure-based testing | Characterization of where components WILL NOT fit vice exhaustive list & test of where it will |
| | Assumes faulty design process | Assumes robust design process that includes characterization of failure modes and overt application of risk management techniques during development |